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Original article

Non-reproduction of *Varroa jacobsoni* in *Apis mellifera* colonies in Papua New Guinea and Indonesia

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Summary — The incidences and reproduction of the ectoparasitic mite, *Varroa jacobsoni* Oud, in colonies of the Asian hive bee, *Apis cerana* F, and the European honey bee, *A mellifera* L, in Papua New Guinea, Irian Jaya and Java are described. At each locality and in colonies of each bee species, adult female mites were present in capped brood cells, with proportionally more drone than worker brood cells infested. In the *A cerana* colonies, female mites reproduced only in capped drone brood cells. In *A mellifera* colonies, there was no evidence of successful mite reproduction on either worker or drone brood. Although not reproducing on *A mellifera* worker and drone brood, or on *A cerana* worker brood, adult female mites were nevertheless feeding and surviving. The inability of female mites to reproduce in *A mellifera* colonies resulted in small, persistent mite infestations in individual colonies that were maintained solely by mites spreading from nearby *A cerana* colonies. There was no evidence that the mites' inability to reproduce in *A mellifera* colonies resulted from extremely slow reproduction, inter-specific competition between *V jacobsoni* and *Tropilaelaps clareae* D & B, resistant bee populations, or climatic conditions. These results have implications for finding and developing novel means of controlling *V jacobsoni* in localities where the mite has become a serious pest of *A mellifera*.

***Apis cerana* / *Apis mellifera* / *Varroa jacobsoni* / reproduction**

INTRODUCTION

The ectoparasitic mite, *Varroa jacobsoni* Oud, is regarded as the most serious pest of honey bee (*Apis mellifera* L) colonies in Europe, the United Kingdom, the Middle East, the Americas and Canada (Bradbear, 1988; Paxton, 1992; Fries, 1993). At these localities mite populations are mostly controlled in bee colonies by the use of chemical acaricides, usually applied to colonies in conjunction with remedial beekeeping practices that involve the manual manipulation of colonies and their hive components (Arnold, 1990; Ritter, 1993a, 1993b). However, many such beekeeping practices tend to be labour-intensive and time-consuming. In addition, the prolonged and sometimes careless application of some acaricides has led to undesirable levels of chemical residues in honey and bees wax

(Lodesani *et al,* 1992) and may eventually result in some mite populations developing acaricide resistance (Wongsiri *et al,* 1987; Ritter and Roth, 1990). Clearly, there is an immediate need for new methods for controlling *V jacobsoni.*

Clues for developing novel means of controlling *V jacobsoni* in *A mellifera* colonies may come from stuyding mite–bee interactions in colonies in which mites show impaired reproductive ability, or in which mite populations are naturally maintained below damage thresholds. To date, there are no reports of mite populations that are totally incapable of reproducing in *A mellifera* colonies. Nevertheless, reports have indicated that mite populations may show seasonal fluctuations and, in rare instances, may even be naturally maintained in colonies at non-damaging levels over relatively long periods of time (Ritter *et al,* 1990; Sakofski *et al,* 1990). Other reports have described active bee defences against mites, which assist in slowing mite population growth (Ruttner and Hänel, 1992). The present paper reports on a study carried out in Papua New Guinea (PNG) and Indonesia in which *V jacobsoni* reproduction appeared normal in colonies of its natural host *A cerana* F but was non-existent in colonies of its adopted host, *A mellifera.* Possible causes of this non-reproduction are discussed.

MATERIALS AND METHODS

Bees and study locations

The colonies of *A mellifera* and *A cerana* examined were located in the West Sepik and Western Provinces of PNG and in the Indonesian territories of Java and Irian Jaya. All colonies examined were hived in wooden boxes except for the *A cerana* colonies in PNG, which were all feral. None of the colonies examined had previously been exposed to chemical acaricides.

The origins of the *A mellifera, A cerana* and *V jacobsoni* examined in Java remain unknown. However, in Irian Jaya, the *A mellifera* colonies were descendants of colonies imported earlier from Australia and Java, while the *A cerana* colonies descended from colonies first introduced from Java during the late 1970s. These first introductions of *A cerana* to Irian Jaya also introduced *V jacobsoni* (Anderson, unpublished data). The *A mellifera* colonies examined in PNG were descendants of colonies imported earlier from Australia and New Zealand (Clinch, 1979), whereas the *A cerana* colonies were descendants of those colonies that were first introduced to Irian Jaya and that subsequently spread across the border into PNG during the mid-1980s carrying *V jacobsoni* (Delfinado-Baker and Aggarwal, 1987; Anderson, unpublished data). Thus, the origins of all the examined *A cerana* colonies and *V jacobsoni* mites can be traced to Java, from where *V jacobsoni* was first described (Oudemans, 1904).

Incidence, reproduction and infestations of V jacobsoni

Sealed worker and drone brood cells of *A mellifera* and *A cerana* were visually examined for adult female *V jacobsoni,* their eggs and offspring. The presence of adult females in these cells was confirmed with the aid of a bright light after carefully removing the wax cell cappings and developing brood using fine forceps. The presence of *V jacobsoni* eggs, proto- or deutonymphs in cells or on the body of bee brood confirmed that the female mites were reproducing. All sealed drone brood cells were examined this way in *A mellifera* colonies and, in addition, attempts were made to examine at least 200 sealed worker brood cells on each of 3 different brood combs, as suggested by Pappas and Thrasyvoulou (1988). However, this was not always possible and normally up to 200 randomly selected worker cells were examined in colonies with 1–3 combs of brood, 200–400 cells in colonies with 4–6 combs of brood, and at least 400 cells in colonies with more than 6 combs of brood. In *A cerana* colonies every sealed drone brood cell present was examined together with as many sealed worker brood cells as time or colony size permitted. Examinations were carried out in Irian Jaya during Sept 1991, in Java during Oct 1991 and in the western regions of PNG during Feb–March, May–June, and

Dec 1991, during March–April, May–June, Sept-Oct and Nov–Dec 1992, and finally during March–April and Aug–Sept 1993.

Evaluation of brood infestation rate

The levels of *V jacobsoni* infestations in *A mellifera* colonies in PNG that had been exposed to *V jacobsoni* for known periods of time was monitored throughout 1991 and 1992 in 2 apiaries at Vanimo, on the tropical north-west coast, and one apiary at Oksapmin, in the temperate-like highlands area of the West Sepik Province. *V jacobsoni* had first been reported from Vanimo during the mid-1980s (Delfinado-Baker and Aggarwal, 1987) while the mite first spread to Oksapmin in July 1990 (Bettesworth, unpublished data). Colonies in apiary 1 at Vanimo were initially established during June 1990 from nucleus colonies imported from *Varroa*-free areas near Goroka in the Eastern Highlands, while colonies in apiary 2 were similarly established, but during Feb 1991. Colonies at Oksapmin were initially established during the early 1980s also from *Varroa*-free nucleus colonies imported from Goroka (Hollingsworth, unpublished data) and, as stated above, first became exposed to *V jacobsoni* in July 1990. Capped worker brood cells in colonies at both localities were examined for the presence of adult female mites and their offspring, as described above.

Survival and feeding of mites

Tests were conducted to determine how long non-reproducing adult female *V jacobsoni* mites could survive in the presence and absence of capped *A cerana* and *A mellifera* worker pupae. Such results, together with direct observations, indicated whether or not female mites fed on the brood. For these tests 10 *Varroa*-infested white-eyed pupae of each bee species were located on brood combs and removed from their cells. Each was placed, together with its infesting mite, into a 1.8 ml Nunc cryo tube (InterMed) and held in a portable incubator that fluctuated between 30 and 34°C. A further 10 mites were removed from white-eyed pupae of each bee species and each placed alone into an individual cryo tube and held at 30–34°C. The survival of all mites was then monitored every 24 h.

Other observations

An indication of brood mortality in *A cerana* colonies was obtained by counting the number of empty brood cells and cells containing eggs or larvae less than 3 d old in areas of comb containing 500 capped brood cells.

The length of the post-capping stage of *A mellifera* worker brood was determined. Brood cells in the process of being capped by nurse bees in 7 colonies at Vanimo and 3 at Oksapmin were delineated on combs by destroying surrounding brood cells, and then checked every 24 h to determine the time to bee emergence.

To determine whether the presence of the ectoparasitic bee mite *Tropilaelaps clareae* D & B affected the reproduction of *V jacobsoni*, the presence of this mite was noted in capped brood cells of *A mellifera* and *A cerana* colonies when testing for the presence of *V jacobsoni*.

RESULTS

Incidence and reproduction of V jacobsoni

The incidences and reproduction of *V jacobsoni* on capped *A cerana* and *A mellifera* worker and drone brood in colonies at Java, Irian Jaya and PNG during 1991–1993 are summarised in tables I and II, respectively.

In *A cerana* colonies at each site, chi-square tests indicated that significantly more drone brood than worker brood were proportionally infested with adult mites. Live adult mites were observed on all developmental stages of drone and worker brood, but reproducing mites were only observed on drone brood (tables I and II). Thus, the incidence and reproduction of *V jacobsoni* in *A cerana* colonies during the present study was similar to that reported from other countries (Koeniger *et al*, 1981; Wongsiri *et al*, 1987; Tewarson *et al*, 1992; Rosenkranz *et al*, 1993).

Table I. Capped worker cells infested with adult female *V jacobsoni* (FVJ) and reproducing female *V jacobsoni* (RFVJ) in *A cerana* (Ac) and *A mellifera* (Am) colonies in Java, Irian Jaya and Papua New Guinea (PNG) during 1991–1993*.

Location/Year	*Bee species*	*No of colonies examined*	*No of cells examined*	*No of cells with FVJ*	*No of infested cells with RFVG*
PNG/1991	Ac	11	3 490	56	0
PNG/1991	Am	64	29 414	567	0
PNG/1992	Ac	13	10 387	734	0
PNG/1992	Am	34	13 109	163	0
PNG/1993	Ac	5	2 624	98	0
PNG/1993	Am	25	10 687	255	0
Java/1991	Ac	4	1 328	35	0
Java/1991	Am	9	3 751	25	0
Irian Jaya/1991	Ac	10	3 040	120	0
Irian Jaya/1991	Am	14	3 799	54	0
Totals (percentages)					
A cerana		43	20 869	1 043 (5.0)	0 (0.0)
A mellifera		146	60 760	1 064 (1.8)	0 (0.0)

* A further 24 *A mellifera* colonies in PNG, 5 in Java and 1 in Irian Jaya were found free of *V jacobsoni* and were not included here.

Table II. Capped drone cells infested with female *V jacobsoni* (FVJ) and reproducing female *V jacobsoni* (RFVJ) in *A cerana* and *A mellifera* colonies in Java, Irian Jaya and Papua New Guinea (PNG) during 1991–1993.*

Location/Year	*Bee species*	*No of colonies examined*	*No of cells examined*	*No of cells with FVJ*	*No of infested cells with RFVG*
PNG/1991	Ac	11	1 011	534	446
PNG/1991	Am	64	2 102	160	1[a]
PNG/1992	Ac	13	1 232	784	644
PNG/1992	Am	34	1 600	66	0
PNG/1993	Ac	5	244	105	85
PNG/1993	Am	25	2 572	183	1[b]
Java/1991	Ac	4	74	48	35
Java/1991	Am	9	234	7	0
Irian Jaya/1991	Ac	10	610	282	228
Irian Jaya/1991	Am	14	1 034	56	0
Totals (percentages)					
A cerana		43	3 171	1 753 (55.3)	1 438 (82.0)
A mellifera		146	7 542	472 (6.3)	2 (0.4)

* See text for experimental details. A further 24 *A mellifera* colonies in PNG, 5 in Java and 1 in Irian Jaya were found free of *V jacobsoni* and are not included here. [a] Cell contained a brown-bodied *A mellifera* drone pupa, 1 live adult female *V jacobsoni* and 1 dead *V jacobsoni* protonymph. [b] Cell contained a brown-bodied *A mellifera* drone pupa, 1 live adult female *V jacobsoni* and 3 dead *V jacobsoni* protonymphs.

As in the *A cerana* colonies, significantly more drone than worker brood was proportionally infested with mites in the *A mellifera* colonies at each site (tables I and II), and live adult mites were observed on all developmental stages of drone and worker brood. However, unlike in the *A cerana* colonies, there was no evidence in the *A mellifera* colonies of successful mite reproduction on either worker or drone brood. On only 2 occasions during the course of this study were mite offspring ever observed in *A mellifera* brood cells. One of these cells contained a drone pupa, a live adult female mite and 3 dead, white protonymphs while the other cell also contained a drone pupa and a live adult female mite, but only 1 dead protonymph (table II). Thus, even though reproduction had been initiated by these 2 mites, it subsequently failed.

Evaluation of brood infestation rate

Percentages of capped *A mellifera* worker cells infested with *V jacobsoni* mites in colonies in 3 apiaries in PNG after periods of exposure to *V jacobsoni* are shown in figure 1. In no instances during this work were reproducing mites observed in the cells. After these colonies first became infested with *V jacobsoni,* the numbers of infested brood cells slowly increased but thereafter never rose above 4% of cells infested. Thus, the inability of female mites to reproduce in the colonies resulted in small, persistent mite infestations in individual colonies that could only have been maintained by mites spreading from nearby *A cerana* colonies.

Survival and feeding of mites

In vitro investigations of the survival of non-reproducing adult female *V jacobsoni* in the presence or absence of *A cerana* and *A mellifera* worker brood showed that mites removed from their white-eyed pupal host and kept in isolation survived for up to 96 h, whereas similar mites kept with their host survived until termination of the experiment (at 192 h). Those mites removed from their host moved freely in their containers at first and produced little anal excreta. However,

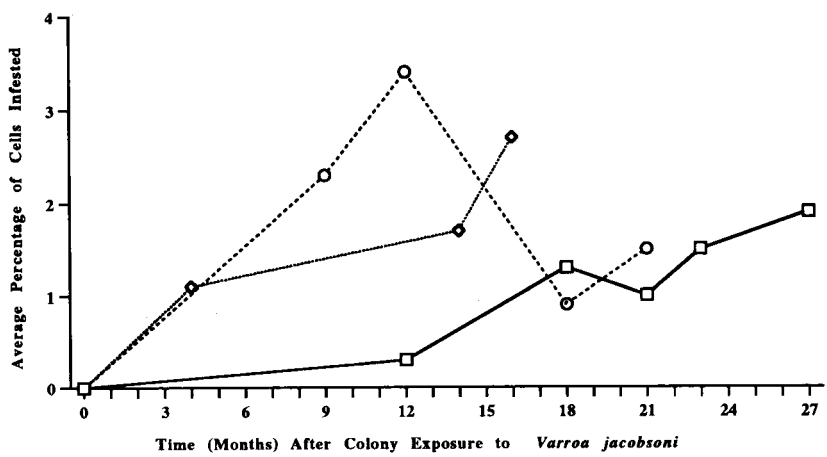

Fig 1. The percentages of capped worker brood cells infested with adult female *V jacobsoni* in *A mellifera* colonies at 3 localities in Papua New Guinea at different time intervals after being introduced to areas containing *V jacobsoni.* —□— Colonies at apiary 1 (Vanimo); ·····◊····· colonies at apiary 2 (Vanimo); and ----O---- colonies at apiary 1 (Oksapmin).

after 24 h they become sluggish before eventually dying prematurely. Those mites kept with their host moved freely over their host feeding and depositing noticeable amounts of white anal excreta. Other investigations showed that these excreta were also present on mite-infested *A cerana* worker brood and *A mellifera* worker and drone brood in normal colonies. However, it was almost invariably located in accumulations, together with the female mite, ventrolaterally on the posterior abdominal tergites of the developing brood in a similar manner to that reported for infertile female *V jacobsoni* by Ruttner *et al* (1984). This indicated that invading mites did not move freely about the cells, and were perhaps restricted to the posterior region of brood by some factor associated with the brood. These results and observations, together with the observation given above of female mites being found on all stages of *A cerana* worker brood and *A mellifera* worker and drone brood, indicate that, although female mites in *A mellifera* colonies and in capped *A cerana* worker cells were not reproducing, they were nevertheless surviving and feeding on the brood.

Other observations

In brood mortality studies the percentage of empty cells or cells with eggs or larvae less than 3 d old in capped *A cerana* worker brood cells in individual colonies ranged from 12 to 51% with a mean of 38% in PNG, from 22 to 46% with a mean of 35% in Irian Jaya, and from 7 to 15% with a mean of 11% in Java. Thus, the individual *A cerana* colonies in PNG and Irian Jaya showed signs of greater brood mortality than colonies in Java.

The post-capping stage of *A mellifera* worker brood in PNG extended from 9–10 to 12–13 d. At Vanimo, 1% of the brood cells examined had post-capping periods of 9–10 d, 32% 10–11 d, 64% 11–12 d, and 3% 12–13 d. At Oksapmin 17% of the brood cells examined had post-capping periods of 10–11 d, 71.5% 11–12 d and 11.5% 12–13 d. Thus, the length of the post-capping stage of the *A mellifera* brood examined here was similar to that reported for the *Varroa*-susceptible *A mellifera carnica* (Moritz, 1985; Büchler, 1990; Mortiz and Mautz, 1990).

DISCUSSION

The most significant finding of the work reported here was the total inability of adult female *V jacobsoni* to reproduce in *A mellifera* colonies in PNG, Irian Jaya and Java. This finding was surprising given that: (a) all female mites observed and examined were descendants of mites from Java from where the original *V jacobsoni*-type specimens were obtained (Oudemans, 1904); (b) previous studies had indicated that *V jacobsoni* mites from PNG and other countries were 1 cosmopolitan species (Delfinado-Baker and Houck, 1989); and (c) the infestation and reproduction of female *V jacobsoni* in *A cerana* colonies as determined in the present study were similar to those reported in other countries (Koeniger *et al*, 1981; Wongsiri *et al*, 1987; Tewarson *et al*, 1992; Rosenkranz *et al*, 1993), except Korea where mites reproduce on both worker and drone brood (De Jong, 1988). The cause of this non-reproduction is unknown. However, evidence suggests that certain factors can probably be dismissed as possible causes. For example, it would appear unlikely that slow *V jacobsoni* reproduction was responsible because, even allowing for the possibility of extremely slow reproduction, some successfully reproducing mites should have been detected here given the large number of *Varroa*-infested cells found (≈ 1 500), among a relatively large number of capped brood cells examined (≈ 68 000)

in a relatively large number of bee colonies (146), some of which had been infested with *V jacobsoni* for several years (see tables I and II). There was also no evidence that inter-specific competition between *T clareae* and *V jacobsoni* accounted for the observed non-reproduction as 35% of the colonies containing non-reproducing mites were totally free of *T clareae*. The different origins and hence different genetic backgrounds of *A mellifera* in PNG and Indonesia would seem to exclude the likelihood that all the colonies examined were genetically resistant to *V jacobsoni*. Although possible, it also seems unlikely that environmental factors such as temperature and humidity resulted in the non-reproduction, as the *A mellifera* colonies examined were located in both hot-tropical and cool-temperate localities where the reproduction of the mite was not impaired in colonies of its natural host *A cerana*.

Two areas of study that might help identify the cause of the observed non-reproduction are mite taxonomy and mite reproductive biology. It may be that the *Varroa* mites examined in PNG and Indonesia were genetically different from those in other localities even though studies to date have failed to detect any difference. The use of modern molecular taxonomy techniques might help clarify this. Nevertheless, a detailed examination of events that occur immediately following the invasion of brood cells by female mites might also help to identify a cause. The fact that, in this study, female mites entered *A mellifera* colonies and then proceeded to infest more drone than worker brood of the right age before proceeding to feed and survive on the brood suggests that the mites were proceeding toward reproduction, and presumably recognizing similar cues to those recognized in colonies of their natural host. Nevertheless, the observation that oviposition did not eventuate in almost all these mites suggests that the mites may not have recognized a crucial factor needed to trigger oviposition or that a factor needed for oviposition was present in too small a concentration to be recognized. In recent years juvenile hormone III (JH III) has received some attention in relation to *V jacobsoni* reproduction, mainly because Oliver *et al* (1985) reported that JH affected reproduction of the mite *Dermanyssus gallinae*. However, even though Hänel and Koeniger (1986) reported that the concentration of JH III in *A mellifera* affected *V jacobsoni* reproduction, a more recent study by Rosenkranz *et al* (1993) indicated that *V jacobsoni* reproduction was not regulated by *A mellifera*-derived JH. Hence, it seems unlikely that JH III levels would be a contributing factor in the non-reproduction reported here. Perhaps future efforts would be more productively directed at attempting to isolate the cause of the non-reproduction to either the mite, the bees or to some other component in the environment. A worthwhile experiment might be to test *A mellifera* colonies that have proven to be susceptible to *V jacobsoni* in Europe for their susceptibility to *V jacobsoni* in PNG. An examination of the components of *A mellifera* and *A cerana* drone larval food in PNG might also prove worthwhile, as Milani and Chiesa (1990) argue that specific factors are probably necessary for successful reproduction of *V jacobsoni*, and that one of these factors seems to be contained in larval food.

In conclusion, the results of this study have shown the uncertainty that may be associated with predicting likely impacts of pest species in particular localities based on what is known about those pests in other localities. An immediate determination of the cause of the non-reproduction of *V jacobsoni* in *A mellifera* colonies as reported here would seem worthwhile as it would provide a better understanding of the *A mellifera–V jacobsoni* relationship. It may even present clues for developing new methods for controlling *V jacobsoni* in those countries where the mite has become a serious pest of *A mellifera*.

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Résumé — Non reproduction de *Varroa jacobsoni* Oud dans des colonies d'*Apis mellifera* L en Papouasie Nouvelle-Guinée et en Indonésie. La présence et la reproduction de l'acarien parasite *V jacobsoni* ont été étudiées dans des colonies d'*Apis cerana* Fabr et d'*A mellifera* en Papouasie Nouvelle-Guinée (PNG) à différentes reprises entre 1991 et 1993, à Irian Jaya en septembre 1991 et à Java en octobre 1991. Dans les colonies d'*A cerana*, comme dans les colonies d'*A mellifera*, il y avait significativement plus de couvain de mâles que de couvain d'ouvrières infesté par des acariens adultes, quelle que soit la localité. Dans les colonies des 2 espèces, des acariens adultes vivants ont été observés sur tous les stades de développement du couvain de mâles et d'ouvrières. Chez *A cerana*, des acariens qui se reproduisaient n'ont été vus que sur le couvain de mâles, en revanche chez *A mellifera* aucune reproduction d'acarien sur couvain de mâles ou sur couvain d'ouvrières n'a été observé. En PNG quelques colonies indemnes de varroas ont été placées à proximité de colonies infestées et suivies à intervalles réguliers. Le taux d'infestation du couvain a augmenté lentement mais n'a jamais dépassé 4%. Ainsi l'incapacité des femelles de *V jacobsoni* à se reproduire dans ces colonies a résulté en une infestation faible et persistante, qui ne pouvait être maintenue que par des acariens venant de colonies d'*A cerana* proches. La survie des femelles de *V jacobsoni* ne se reproduisant pas a été étudiée *in vitro* en présence de couvain d'*A mellifera* ou d'*A cerana* ou en l'absence de tout couvain. Des acariens retirés des nymphes au stade yeux blancs et maintenus isolés ont survécu jusqu'à 96 h alors que, mis sur du couvain, ils étaient encore vivants à la fin de l'expérimentation au bout de 192 h. Ces résultats, ainsi que d'autres observations, montrent que les acariens survivent sur le couvain et s'alimentent, même s'ils ne peuvent se reproduire dans les colonies d'*A mellifera* et dans les cellules de couvain d'ouvrières d'*A cerana*. Il n'y a aucune données indiquant que l'incapacité de *V jacobsoni* à se reproduire dans les colonies d'*A mellifera* provient d'une reproduction particulièrement lente, d'une compétition inter-spécifique entre *V jacobsoni* et *Tropilaelaps clareae* Delfinado et Baker, de populations d'abeilles résistantes ou des conditions climatiques. La cause reste inconnue. Ces résultats peuvent être utiles pour rechercher et mettre au point de nouveaux moyens de lutte contre *V jacobsoni* dans des régions où cet acarien représente un danger sérieux pour *A mellifera*.

***Apis cerana* / *Apis mellifera* / *Varroa jacobsoni* / reproduction / relation hôte-parasite / Papouasie Nouvelle Guinée**

Zusammenfassung — *Varroa jacobsoni* Oud ohne Nachkommenserzeugung in Völkern von *Apis mellifera* L in Papua-Neuguinea und Indonesien. Das Vorkommen und die Reproduktion der außenparasitischen Milbe *Varroa jacobsoni* Oud in Völkern von *Apis cerana* F und *Apis mellifera* L wurde in Papua Neuguinea in unterschiedlichen Zeitabständen während der Jahre 1991–1993, in Irian Jaja im September 1991 und in Java im Oktober 1991 untersucht. In den *Apis cerana* Völkern aller Standorte waren signifikant mehr Drohnenbrutzellen als Arbeiterinnenbrutzellen mit adulten Milben befallen. Während in allen Entwicklungsstadien der Arbeiterinnen- und Drohnenbrut erwachsene Milben gefunden

wurden, enthielten nur die Drohnenbrutzellen reproduzierende Milben. Ebenso war auch in den *Apis mellifera* Völkern aller Standorte die Drohnenbrut signifikant stärker von adulten Milben befallen als die Arbeiterinnenbrut. Auch hier enthielten alle Entwicklungsstadien der Bienenbrut lebende Varroamilben. Abweichend von den *Apis cerana* Kolonien gab es hier allerdings weder in der Arbeiterinnen- noch in der Drohnenbrut Anzeichen für eine erfolgreiche Vermehrung der Milben. Einige varroafreie *A mellifera* Völker wurden in PNG in der Nähe von mit *Varroa jacobsoni* infizierten Völkern aufgestellt und in verschiedenen Abständen untersucht. Es zeigte sich ein allmählicher Anstieg des Brutbefalls, der aber zu keinem Zeitpunkt mehr als 4% der Zellen überschritt. Die Unfähigkeit der weiblichen Milben, innerhalb dieser Völker zu reproduzieren, hatte daher einen zwar beständigen, aber stets geringfügigen Befall der einzelnen Völker zur Folge. Dessen Aufrechterhaltung wird ausschließlich auf die Verbreitung der Milben aus den benachbarten *A cerana* Völkern zurückgeführt. Es wurden *in vitro* Untersuchungen zur Überlebensdauer reproduktionsloser adulter Varroaweibchen entweder auf Arbeiterinnenbrut von *A cerana* oder *A mellifera* oder ohne Brut durchgeführt. Milben, die von Puppen mit weißen Augen entnommen worden waren, überlebten in Isolation bis zu 96 h, während auf Brut gehaltene Milben bei Abbruch des Experiments nach 192 h noch lebendig waren. Zusammen mit weiteren Beobachtungen deuten diese Ergebnisse darauf hin, daß Milben auf Brut überleben und Nahrung aufnehmen, auch wenn sie in Völkern von *A mellifera* und in Arbeiterinnenbrutzellen von *A cerana* nicht reproduzieren können. Da es auch keine Anzeichen dafür gab, daß die Unfähigkeit von *V jacobsoni* in *A mellifera* Völkern zu reproduzieren auf eine besonders verlangsamte Reproduktion, auf zwischenartliche Konkurrenz mit *Tropilaelaps clarae* D & B, auf resistente Bienenpopulationen oder auf die klimatischen Bedingungen zurückzuführen ist, sind die Ursachen hierfür unbekannt. Diese Ergebnisse könnten für die Entdeckung oder Entwicklung neuer Möglichkeiten einer Bekämpfung der Milben in Gebieten, in denen *V jacobsoni* eine ernsthafte Gefährdung der Bienen darstellt, von Bedeutung sein.

***Apis cerana* / *Apis mellifera* / *Varroa jacobsoni* / Reproduktion**

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